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              MODIS Reprojection Tool (MRT) Release Notes
                         Version 3.1
                         March 2003
                    USGS EROS Data Center
          South Dakota School of Mines and Technology
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Capabilities
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1. MODIS Data Products

The MODIS Reprojection Tool currently allows the user to reproject
gridded (Level-2G, Level-3, and Level-4 land products) MODIS data products.
Support for swath (Level-1 and Level-2) data products is not currently planned.

2. Map Projections

The MODIS Reprojection Tool allows the user to reproject from the
Integerized Sinusoidal Projection to the following map projections:

    * Albers Equal Area
    * Geographic
    * Hammer
    * Integerized Sinusoidal
    * Interrupted Goode Homolosine
    * Lambert Azimuthal
    * Lambert Conformal Conic
    * Mercator
    * Mollweide
    * Polar Stereographic
    * Sinusoidal
    * Transverse Mercator
    * Universal Transverse Mercator

In addition, the MRT will now input the above projects as well.

3. ISIN-Enhanced GCTP

As part of this software, the Generalized Cartographic Transformation
Package (GCTP) has been modified to incorporate the new Integerized
Sinusoidal Projection.

4. Spectral Subsetting

Any subset of the input bands may be selected for reprojection. The
default is to reproject all input bands.

5. Spatial Subsetting

Two corners (upper left and lower right) of a rectangle in input/output
space may be specified. These corners may be given as coordinates in input
latitude and longitude, input line/sample pairs, or output projection
coordinates. If specifying line/sample pairs specify as (start line, start
sample) and (end line, end sample), using a zero-based coordinate system
where the upper left corner is (0, 0). When specifying input lat/long or
input line/sample, the other two rectangle corners (upper right and lower
left) are computed automatically in input space. Then all four corners are
reprojected into output space, using the specified map projection and
datum. Finally, a minimum-bounding rectangle is computed that contains the
four reprojected points, in output space. All points inside this rectangle
in output space are mapped back into input space for reprojection. The
default is to reproject the entire input image.

When specifying output projection coordinates, specify as (start projection x, start projection y) and (end projection x, end projection y). These coordinates must be specified in the same units as is used for the projection (degrees for geographic and meters for all other projections). The upper right and lower left corners are computed from the specified upper left and lower right corners to create a rectangle in output space. Using these coordinates in output space, the corners are mapped back into input space to determine the spatial subset corners in input space. The output image corner coordinates should match the user-specified output spatial subset corners, exactly.

6. Resampling

Resampling may be nearest neighbor, bilinear, or cubic convolution. Background fill values are supported. If the majority of values that lie under the resampling kernel are background fill values, then a background fill value is output. Otherwise, resampling is performed only from non-background fill values, and kernel weights are adjusted accordingly.

ISIN data has a shift between lines on a per pixel basis. This shift is linear per line, thus the slope of the shift can be calculated by determining the shift for the first pixel and the shift for the last pixel in a line and dividing by the number of pixels in the line. The MRT resampling processes account for this pixel shift (as of Release 3.0) in the Nearest Neighbor, Bilinear, and Cubic Convolution resampling processes. The shift for SDSs of the same resolution are the same. The shifts will be recalculated when a new resolution is encountered in the image. Shift statistics are output for the user. It is important to note that the shift handling slows down the resampling process, so the user will see a slow-down in the MRT processing times.

7. Datum Conversions

A limited number of input and output datums are supported by the MRT for datum conversions. Supported datums are NAD27, NAD83, WGS66, WGS72, are WGS84. When reprojecting to a sphere-based projection, datum conversions are not allowed. In addition, datums are not output for sphere-based projections. It is up to the user to know the origin of their data. For MODIS users, the MODIS data is "referenced to" the WGS84 datum.

8. Format Conversion

The MRT supports format conversion, which allows the user to output the data to a new data format without resampling the input image. The user may specify spectral and spatial subsetting, along with the output format.

9. Output Pixel Size

An output pixel size may be specified. If so, it will be used for all bands. The default is to use the same input and output pixel size for corresponding input and output bands.

10. Data Types

The MODIS Reprojection Tool supports 8-bit, 16-bit, and 32-bit integer data (both signed and unsigned), as well as 32-bit float data. Support for ASCII data is planned. The same data type is used for the corresponding input and output bands.

11. File Formats

HDF-EOS and raw binary files are supported on input. HDF-EOS, GeoTIFF,
and raw binary files are supported on output.

12. Platforms

The MODIS Reprojection Tool is highly portable software. It currently
runs on five different platforms:

    * Windows 95/98/2000/ME/XP
    * Windows NT
    * Linux
    * Sun/Solaris
    * SGI/Irix

(See Caveats below.)

13. Interfaces

The MODIS Reprojection Tool may be invoked either from a user-friendly
GUI or from a powerful command-line interface. The GUI allows novices
and users with light processing requirements to reproject MODIS imagery,
with little training required. The GUI also allows easy inspection of
metadata. The scriptable command-line interface, with its variety of
command-line options, is likely to be the method of choice for
reprojecting large numbers of files.

14. Mosaic Tool

The MODIS Reprojection Tool will allow the user to mosaic several tiles
together, then resample them. The GUI will support the input of several
filenames, or the user may use the mrtmosaic command-line software. The GUI
also provides an option to view which tiles have been selected for processing.

History

Version 3.1 (March 2003)
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1. In Version 3.0a, for Windows platforms, the ViewMetadata option caused
   the GUI to hang. This was due to informational messages being output by
   dumpmeta that the Windows platforms could not handle in the GUI. This
   has been fixed.

2. Added Mercator as another supported projection.

3. When mosaicking more than 15 tiles at one time, the MRT would exit with
   an error message specifying that a certain .hdf file could not be opened.
   This bug has been fixed. In addition, instead of opening all the input
   HDF-EOS files at once and processing the data on a row-by-row basis, the
   mosaic tool now opens only the HDF-EOS files from the current row being
   processed.

4. When reprojecting to Interrupted Goodes Homolosine, the resampler output
   a message stating that "projection 24 was unknown". This occurred in
   the section of the resampler that prints out the projection information.
   This bug has been fixed.

5. When reprojecting bounding tiles to Interrupted Goodes Homolosine, the
   resampler exited with an error while converting the lat/long coordinates
   to output projection coordinates. This was due to the fact that IGH
   contains breaks in the projection. Many of the ISIN bounding tiles fell
   into the IGH interrupted areas. The GCTP software returns an IN_BREAK
   value when the data point falls within the IGH break areas. The resampler

software has been modified to look for the IN_BREAK return value. If that value is returned, the particular pixel is tagged as a background fill pixel and processing continues.

6. Previous versions of the MRT had prevented the user from processing data that crossed the International Dateline. A bug in the international dateline software prevented users from processing valid data that covered the entire globe which did not cross the international dateline. This bug has been fixed.

Version 3.0a (December 2002)
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1. Version 3.0 prevented datum conversions for sphere-based projections. The MRT incorrectly classified Geographic as a sphere-based projection when instead datum conversions should be allowed for the Geographic projection. This has been fixed.

2. Version 3.0 added a check to the subsetting values to verify that an integral number of lines and samples were being processed. If the number of lines or samples was not an integer, then the LR corner was readjusted such that the subset was an integral number of lines and samples. Due to computer roundoff, the implementation added an extra line and sample in almost all cases. This has been fixed.

Version 3.0 (December 2002)
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1. Version 2.3 introduced a bug for line/sample subsetting when using the No_Datum option. This has been fixed.

2. Previous versions of the MRT did not output an exact number of lines and samples. The actual corner points were not an exact number of lines and samples (unless the user was doing a format conversion), even though the MRT output reported an integer value for the lines and samples. After the MRT determined the minimum bounding rectangle in output space, that rectangle was not expanded to be an exact number of lines and samples. Instead it had a fractional number of lines and samples, depending on the image. This has been fixed.

3. Previous versions of the MRT output citation keys in GeoTiff for UTM projections when not outputting to WGS84. The current version will support other datums supported by GeoTiff for UTM. GeoTiff supports WGS84 and WGS72 for all UTM zones (1N - 60N and 1S - 60S). GeoTiff supports NAD27 for UTM zones 3N to 22N. GeoTiff supports NAD83 for UTM zones 3N to 23N. Any other combinations are output by the MRT to GeoTiff using citation keys.

4. Previous versions of the MRT GUI read the .met file associated with the HDF file when pressing ViewMetadata. A new executable now exists that will allow the user to view the metadata associated with the HDF file itself, which is different than viewing the .met file. The ViewMetadata button will now use 'dumpmeta' to output a temporary metadata file for the .hdf file and display it in the GUI. Thus the ViewMetadata file will now display the metadata for the .hdf file itself, not the .met file associated with the .hdf file. If the user wants to use this executable on the command-line, simply type
   'dumpmeta <input HDF file> <output metadata text file>'.

5. A change in version 2.1 or 2.2 of the MRT broke the default GUI spatial subsetting in some cases. If the spatial subsetting in the parameter file was exactly the same as the input UL and LR corners (as is the case when using the GUI and processing the entire image), then the output image

was getting cut off in some cases. If the UR corner was to the east of the
LR corner then the image was cut off at the LR corner, due to this bug
which has now been fixed.

6. A change in version 2.2 did not allow the MRT to process input raw binary
   ISIN files. This too has been fixed.

7. When implementing Cubic Convolution on an area which was highly reflective
   (i.e. cloud region) the MRT was overflowing the double buffer. This has
   been fixed.

8. The MRT will now allow for mosaicking. When using the GUI, the user may
   select several input filenames for processing. The View Mosaic option will
   allow the user to view the tiles that were selected for processing. The
   processing involves mosaicking the tiles selected (only for the specified
   bands) and then resampling the mosaic.
   A command-line version of the mosaic tool also exists. The user can mosaic
   several tiles together by using mrtmosaic on the command-line. The names
   of the tiles must be specified in a parameter file. In addition, the user
   may select which bands to be processed in the mosaic by using the -s switch.

9. The changes made to the MRT GUI for mosaicking require the user to
   use the later versions of Java 1.3 or Java 1.4. Java 1.2 will no longer
   support the functions in the MRT.

10. Added support for Albers Equal Area (AEA or ALBERS_EQUAL_AREA).

11. When outputting sphere values to GeoTiff using the GeogSemiMajorAxisGeoKey
    and GeogSemiMinorAxisGeoKey, some software packages require both the
    GeogSemiMajorAxisGeoKey and GeogSemiMinorAxisGeoKey values to be the
    radius of the sphere. Previously the MRT set the value of the
    GeogSemiMinorAxisGeoKey to 0.0. This has been changed and the
    GeogSemiMinorAxisGeoKey value is now set to the radius of the sphere.

12. ISIN data has a shift between lines on a per pixel basis. This shift is
    linear per line, thus the slope of the shift can be calculated by
    determining the shift for the first pixel and the shift for the last
    pixel in a line and dividing by the number of pixels in the line. The
    MRT resampling processes account for this pixel shift (as of Release 3.0)
    in the Nearest Neighbor, Bilinear, and Cubic Convolution resampling
    processes. The shifts for SDSs of the same resolution are the same. The
    shifts will be recalculated when a new resolution is encountered in the
    image. Shift statistics are output for the user. It is important to note
    that the shift handling slows down the resampling process, so the user
    will see a slow-down in the overall MRT processing times.

13. The previous versions of the MRT were not able to handle sphere radius
    values other than 6370997.0 (radius of sphere 19) for sphere-based
    projections while implementing datum conversions. This was hard-coded
    in GCTP. Version 3.0 of the MRT will support 6371007.181 as a sphere
    radius value in the MODIS Sinusoidal data.

14. The MRT will no longer allow datum conversions when reprojecting to
    sphere-based projections. In addition datums are no longer output for
    sphere-based projections. The MRT used to output WGS84, by default,
    for all projections. However, technically sphere-based projections do
    not have a datum. Thus, now it will be up to the user to know the origin
    of their data. For MODIS users, the original MODIS data is "referenced
    to" the WGS84 datum.

15. The HDF-EOS documentation specifies that when dealing with the Geographic
    projection, the upper left and lower right corner points will be output

   in DMS rather than decimal degrees. Version 3.0 of the MRT outputs
   the upper left and lower right corners for the Geographic projection
   to HDF-EOS data files as DMS. In addition, the MRT also requires the
   input HDF-EOS Geographic corner points to be in DMS. All other projections
   are still expected to be in meters. When dealing with Geographic and
   raw binary data, the MRT still outputs the corner points as decimal
   degrees and requires decimal degrees on input for raw binary as well.

16. Previous versions of the MRT used a minimum-bounding rectangular box
    to determine the spatial subsetting for format conversions. When format
    converting the entire image, it only makes sense to output the image
    exactly as it is and not determine a minimum-bounding rectangle. When
    working in the Western hemisphere, the minimum-bounding rectangle (in
    most cases) produced an output exactly as the input. However, for some
    cases in the Eastern hemisphere, the minimum-bounding rectangle produces
    an output product that contains extra fill on the left and right of the
    image. This issue has been resolved in version 3.0.

17. Users may now set default input, output, and parameter file directories.
    If specified, then the MRT will use these directory settings as the
    default for the specific directory. If not specified, then the MRT will
    use the local directory as the default (which is currently the case).
    Windows users will need to click on the desired directory, then also type
    the final directory name in the text box. Unix and Linux users should be
    able to simply click on the desired directory names. These can be set
    using the 'Settings' option on the MRT GUI toolbar.

Version 2.3 (May 20, 2002)
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1. The MRT was not correctly defaulting to reference the WGS84 datum for
   raw binary data, if an input datum was not specified in the raw binary
   header. This has been fixed.

2. The fix in version 2.2 to handle crossing the International Dateline
   introduced a bug if the data straddles the 0 degrees longitude line.
   This has been fixed.

3. A bug has existed in previous versions of the MRT which crops the output
   image (in some cases) when processing with the GUI. The GUI creates a
   temporary parameter file using the original UL and LR lat/long coordinates
   as the subsetting coordinates. The resampler software then uses the corner
   coordinates from the parameter file to determine the minimum bounding
   rectangular box for output. In many cases, when dealing with the coordinates
   output by the GUI to process the entire image, the bounding rectangular box
   crops the image. Instead of simply using the UL and LR corners (as the
   resampler does when spatial subsetting coordinates are specified), the
   resampler should use the UL, UR, LL, and LR to find the minimum bounding
   rectangular coordinates. In version 3.0 of the MRT, the resampler checks
   the spatial subset UL and LR corners and compares them with the original
   corners in the image. If the spatial subset and the original corners are
   within a small epsilon of each other, then the MRT assumes that the user
   wants to process the entire image and not specifically use the UL and LR
   corners as reported by the GUI. This fix should prevent the cropping seen
   when processing an entire image in the GUI.

   For many tiles (Example 1) this bug will not be a problem, however for
   some tiles (Example 2) this bug is a serious problem.

   UL---------UR   UL---------UR
    -           -   -   -

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         _           _                          _           _
      _           _                          _           _
     _           _                          _           _
    _           _                          _           _
    LL---------LR                   LL---------LR

       * Example 1 *                        * Example 2 *
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4. Previous versions of the MRT have actually been dealing with Geographic units in degrees, not arc-seconds as the User's Guide and the GUI had specified. The User's Guide and GUI have been updated to note that the units are in degrees.

5. The Geotiff output from the MRT still had a couple of tag issues that needed to be fixed so that the output Geotiff data followed the Geotiff standard. Among these issues were that only the UL corner point should be output to the Geotiff tiepoint tag, not all four corner points. Another issue was that the Geographic output was being tagged as both Geographic and user-defined. The user-defined tag was removed.

6. Previous versions of the MRT would not allow the user to enter a pixel size of 0.xxxx into the GUI. The GUI would allow .xxxx, however. Fractional pixel sizes less than one are common for outputting to Geographic, since the units are in degrees (used to be arc-seconds). This error occurred when pressing the Run, the ConvertFormat, or the SaveParameters buttons. This bug has been fixed.

7. Many of the MRT users have noted how the status box in the GUI takes "total" control of the system. In previous versions of the MRT, if you tried to close, minimize, or move the status box to the background, the status box would take focus again. Thus the user could not work on anything else because the status box would always steal the focus. This has been fixed. The status box can now be minimized or placed in the background (and it will remain there until the user brings it to the foreground). The status box can also be closed. If the status box is closed, it will remain closed but the resampler/format converter will continue to run in the background. It will be up to the user to determine when the process has completed ... by viewing the resample.log file and/or the output image files.

8. Previous versions of the MRT did not correctly support unsigned 32-bit or signed 32-bit data. This has been fixed.

9. A temporary fix has been added to allow the user to use the NO DATUM option to specify their own radius of the sphere. The user may now specify the radius of the sphere in the projection parameters (first parameter), however the user must select the NO DATUM option for this user-specified radius to be used. Previous versions of the MRT automatically used the radius of Sphere 19 as the radius of any sphere-based projection, regardless of the value that the user specified.

   If the user is not going to specify their own radius value and instead use an output datum, then 0.0 must be used in the first two projection parameters. This will allow the MRT to use the default value in GCTP.

   If the user chooses to use the NO DATUM option for the output product, the MRT will also require that the radius of the sphere (for the input projection) is specified in the input projection parameter as well. This is not a problem for the traditional MODIS ISIN HDF-EOS data, but it may be a problem for other non-traditional data sets that the MRT will support.

10. Version 2.2 of the MRT would not allow the user to specify the latitude
    and longitude of their UTM zone, if a datum had been specified. Thus
    only the UTM zone number could be used with a datum. This has been
    fixed and the user can now specify the first two projection parameters
    instead of the UTM zone, even when specifying a datum.

11. Previous versions of the MRT allowed the user to specify the radius of
    the sphere or the semi-major and semi-minor values in the first two
    projection parameters, along with specifying a datum. The MRT then
    checked the first two projection parameters with default values for
    that projection and datum in GCTP. If the first two projection
    parameters did not agree with the defaults in GCTP (when also specifying
    a datum), then the MRT would exit with an error. This has been a point
    of confusion for many users, thus the MRT will no longer allow the
    user to specify both the first two projection parameters (except for
    UTM) and the output datum. If the user wants to specify their own
    radius of the sphere or semi-major and semi-minor, then the NO_DATUM
    option must be used.

12. Previous versions of the MRT specified the Vgroup name of the output
    HDF-EOS files to be the output filename plus the output pixel size.
    If the input file is an HDF-EOS file, then the output HDF-EOS file
    will now retain the Vgroup name of the input HDF-EOS file. If the
    input file is a raw binary file, then the Vgroup naming convention
    uses the output filename plus the output pixel size.

Version 2.2 (February 15, 2002)
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1. A bug was introduced in Release 2.1 that added an extra line and sample
   to the output product. This same bug also caused the pixel size to be
   incorrect. This has been fixed.

2. Previous versions of the MRT have not been able to process the bounding
   ISIN tiles (tiles on the outer edge of the ISIN projection). Version 2.2
   now has the capability to handle these tiles. In addition, an issue in
   previous versions arose when a tile crossed the International Dateline.
   Version 2.2 can now handle this as well.

3. Users reported problems ingesting the GeoTiff files created by the MRT
   into other GIS packages. The output GeoTiff files from the MRT now follow
   the GeoTiff "standard" that is supported at the USGS EROS Data Center.
   ENVI should support the GeoTiff products output by the MRT, however we
   realize that some other software packages still may not be able to ingest
   these GeoTiff products.

4. The format conversion option has been changed in Version 2.2 to output
   exactly the input file. No minimum bounding rectangle is created around
   the input data, like with the resampling option.

5. We realize that some users want to be able to compare their output data
   with data that may be referenced other datums than WGS84. Version 2.2 of
   the MRT now supports datum conversions. A limited number of input/output
   datums are supported (NAD27, NAD83, WGS66, WGS72, WGS84, NODATUM). The
   NODATUM option allows the user to specify the semi-major and semi-minor
   axes in the projection parameters. WGS84 is used by default. If you are
   doing a datum conversion, expect the processing time to be 5-10 times
   slower than simply reprojecting without a datum conversion. For our users
   that use the GCTP and Geolib (datum conversion layer), a bug fix was made
   in Geolib to support the specified datums.

6. In many cases, the data output (especially in Geographic projections) by

the MRT was not able to be input back into the MRT. These problems have
been fixed.

7. When outputting HDF-EOS files from input raw binary data, the output
   HDF-EOS files did not contain all the grid data as when going from
   HDF-EOS to HDF-EOS. The raw binary to HDF-EOS conversions now contain
   the appropriate grid information for the output HDF-EOS file.

8. A request was made by our users to be able to specify the spatial subset
   in output projection coordinates. This request has been implemented in
   Version 2.2. Spatial subsetting can now be input lat/long, input
   line/sample, and output projection x/y.
   *** This change will require a change to your existing parameter files.
   If the SPATIAL_SUBSET_UL_CORNER or SPATIAL_SUBSET_LR_CORNER are specified
   in your parameter files, you MUST specify the SPATIAL_SUBSET_TYPE to be
   INPUT_LAT_LONG, INPUT_LINE_SAMPLE, or OUTPUT_PROJ_COORDS. Thus your
   parameter files now need to have the SPATIAL_SUBSET_TYPE parameter in
   order for the MRT to process your spatial subset corners properly. ***

9. Previous versions of the MRT have not been able to correctly subset an
   image when line/sample spatial subsetting was specified and the output
   projection type was geographic. This has been fixed.

10. Previous versions of the MRT have not properly processed 3-dimensional
    data products where the 3rd dimension was listed before the XDim and
    YDim dimensions (i.e. "Num_QC_Words", "YDim", "XDim" in the MOD12Q1 data
    products). This problem has been fixed and the MRT can properly handle
    3-dimensional data products with the dimensions listed in any order.
    The 4-dimensional data products were not affected by this bug.

11. Information on the different resampling types (NN, CC, and BI) has been
    added in the User's Guide. This information is to help the MRT users
    to understand the differences between these options. In addition,
    information on the ISIN bounding tiles and datum conversions has also
    been added in the User's Guide.

Version 2.1 (August 20, 2001)
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1. A bug was introduced in Release 2.0 that broke the use of many
   command-line parameters. This has been fixed.

2. The GCTP software that was received from the USGS EROS Data Center used
   the radius of Sphere 19 (which is 6370997.0) instead of the radius of the
   MODIS sphere (which is 6371007.181). This bug has been fixed in the MRT
   GCTP software. This bug caused the output coordinates to be off by less
   than a pixel.

3. Bi-directional support has been added to the MRT. All output projections
   are now supported as input projections.

4. Format conversion is now available. This allows the input data to be output
   to a different data format without going through the resampling process. The
   user can specify spatial and spectral subsetting, along with the output data
   format.

5. The bounding tiles in the ISIN projection have at least one corner point that
   does not map to a valid latitude/longitude. Currently the MRT will not
   process these tiles due to the invalid latitude/longitude. We are working on
   a fix to support these tiles.

6. For the Windows users, a ModisTool icon has been created. See the User's
   Guide for setting up a shortcut for the MRT.

7. A bug existed in the GUI when saving and resaving parameter files. This bug
   has been fixed.

Version 2.0
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1. Transverse Mercator has been added to the list of output projections.

2. The user is now allowed to choose from WGS84, GRS80, and CLARKE1866
   for the UTM output projection. The default ellipsoid is WGS84, which has
   been the ellipsoid used for all previous releases. Both the GUI and the
   command-line resampler support the choice of ellipsoid. The ellipsoid
   value can be specified under Edit Projection Parameters for the UTM
   projections (along side the UTM Zone). The parameter file supports an
   ELLIPSOID_CODE parameter for specifying the output ellipsoid for the
   output UTM projection.

3. Cosmetic changes have been made to the GUI, along with some minor bug
   fixes. An Exit button has been added next to the Run button to allow for
   easier exiting from the MRT. The Resampling Type automatically defaults
   to Nearest Neighbor to match the command-line resampler. The View
   Metadata box can be left up while running the MRT. Previously the user
   had to close the View Metadata box before continuing in the MRT GUI.
   Similarly, the Status dialog box that pops up after pressing Run can now
   be minimized/maximized. Previously this box needed to remain in the
   foreground.

4. A bug was introduced in Version 1.2 that did not allow the user to do
   spatial subsetting from the GUI. The user was allowed to change the
   UL and LR corners in the GUI, however the entire image would be processed.
   This has been fixed in Version 2.0.

5. The View Metadata option in the GUI used to look for a metadata file of
   the name <basename>.met. Now the View Metadata option will look for and
   view the metadata for any file of the following names (in the listed order):
       <basename>.hdf.met
       <basename>_hdf.met
       <basename>.met

   For raw binary files, the following file formats will be supported by the
   View Metadata option (mainly for consistency):
       <basename>.hdr.met
       <basename>_hdr.met
       <basename>.met

6. Minor bug fixes have been made to the GeoTiff output format, which will
   hopefully prevent the past problems of ingesting the GeoTiff files into
   ENVI, ERDAS, IDL, and other such packages.

7. MOD11A1 and MOD12A1 both have internal data errors that did not allow
   them to be processed correctly by the MRT. The SphereCode is set to 1
   in these files, instead of -1. The MRT has a work-around for this
   SphereCode and will now process these data products. In addition, the
   MOD11A1 data files would cause a core dump in the MRT. This has also
   been fixed.

8. The MRT will now support multigrid/multiresolution data (i.e. MOD09Q1).

9. The MRT will now support 3D/4D data. Each 3D or 4D slice will be named
   using the following format:
   <SDSname>.<third dimension name>_#.<fourth dimension name>_#

where # is a 2-digit number representing the slice in that dimension
that was processed. This naming convention produces very long names,
which is not currently supported in the Windows version of the MRT.
In the case of working on Windows and running the MRT on 3D/4D data
products with long SDS and/or dimension names, the MRT will instead
use the following format:
<SDSname>.3_#.4_#

10. Using the command-line resampler, the resample.log file can be renamed.
    The -g option will allow the user to specify a different name for the
    resample.log file. A full path can be specified with this name.

11. The MRT is not currently handling data that are very close to or straddle
    the International dateline. We are working on a fix for this problem. This
    has mainly been reported in the MOD13A1 data products.

12. The MOD09GHK data products have output the data attributes in a different
    order than the image data itself. The MRT had made the assumption that the
    data attributes would be output in the same order as the image data. This
    causes a problem in the MOD09GHK data files, but only with the last SDS
    which is the number of observations. We are working on a work-around for
    this problem.

Version 1.2
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1. In Version 1.1 we introduced a spatial subsetting (Lat/Long) stipulation
   that the UL corner should be to the left of the LR corner. This was an
   invalid assumption and has been removed in Version 1.2.

2. In the resampling process when a pixel falls outside the image boundary,
   previous versions of the MRT assigned this pixel a value of zero.
   Version 1.2 now uses the Background Fill Value for pixels that fall
   outside the image boundary. If the Background Fill Value is not available,
   then a value outside of the Valid Range is used. If the Valid Range is not
   available, then the pixel is assigned a value of zero.

3. For the HDF-EOS output images, the Dataset Attributes have been carried
   through. These attributes include: long_name, units, valid_range,
   _FillValue, Nadir Data Resolution, scale_factor, scale_factor_err,
   add_offset, add_offset_err, and calibrated_nt. Since these attributes
   are not supported in the raw binary header, the scale_factor and
   offset are output as comments at the end of the raw binary header file.

4. Bug fix: When specifying a new input file and output information,
   selecting Geographic as the Output Projection Type did not show
   the units (arc-sec) in the Output Pixel Size Units box. Fixed.

5. Back due to popular demand! The command "resample -h file.hdf" produces
   a raw binary header file named TmpHdr.hdr from an HDF-EOS file (file.hdf).
   This functionality was previously available via the command "hdf2hdr",
   which is no longer included in the distribution.

Version 1.1
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1. Windows version of MRT GUI now runs similarly to UNIX platforms.

2. Installation script is more robust, provides more defaults.

3. New command-line options: -u UTM_zone and -x pixel_size

4. Bug fixes:

   a. Resampler failed for HDF-EOS input, raw binary output. Fixed.
   b. Spatial subsetting was incorrect. Fixed.

5. Reorganized directory structure. Old geolib/gctp and geolib/geolib
   subdirectories are now just gctp and geolib.

Version 1.0
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1. First public release.

2. Installation scripts provided.

3. Switched from DJGPP compiler to CygWin compiler on Windows, solved long
   filename problem on Windows NT.

4. Many added capabilities and bug fixes from beta release.

5. Windows version of MRT GUI runs differently than UNIX versions
   (to run resampler, must exit GUI, open a DOS box, then restart GUI).

Caveats
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1. MODIS swath (Level-1 and Level-2) data is not supported. Only Level-2G,
   Level-3, and Level-4 Land products are supported in HDF-EOS.

2. The output GeoTiff products follow the GeoTiff standard that has been
   in use at the USGS EROS Data Center. ENVI supports the output GeoTiff
   products from the MRT, be we have been informed that other software
   does not always support ingesting our GeoTiff products.

3. The GCTP software automatically uses the radius of Sphere 19 when
   reprojecting to a sphere-based projection. To work around this caveat,
   the user should use the No Datum option and specify the desired
   sphere radius in the first projection parameter.

4. When using the No Datum option, the software requires that the projection
   parameters are used to specify the radius of the sphere or the semi-major
   and semi-minor of the output spheroid. The software also requires that
   the projection parameters be used for the input data product as well.
   The input datum will not be used.

5. Many versions of Windows are hanging the MRT GUI when trying to process
   data products which live in a directory name that uses blank spaces. It
   is highly recommended that directory names with blank spaces NOT be used
   in the MRT. For example, "c:\Modis Data" should instead be "c:\ModisData".

Installation

Obtain the MODIS Reprojection Tool software by downloading the
appropriate installation files for your platform from the USGS EROS Data
Center MODIS Reprojection Tool Web site
(http://edc.usgs.gov/programs/sddm/modisdist/index.shtml). The
installation files include a zip archive containing the MRT software
(MRT_Sun.zip, MRT_Win.zip, etc.), an installation script (install), and
an executable file named unzip. (On the Windows platform, there will be
several other executable files as well.) These executable files (install,
unzip, *.bat, *.exe) need to have execute permissions. After downloading
these files from the webpage, make sure these files have execute permissions

before starting with the installation process. Ask your system administrator
if you do not understand file permissions.

Installation requires that the zip archive be unpacked into an
appropriate directory on your system. This process will create an MRT
directory containing several subdirectories (bin, data, doc, geolib,
include, JavaGuiSrc, lib, src). Once the software has been unpacked, the
MRT bin directory need to be added to your path, and an environment
variable named MRTDATADIR needs to be set to the MRT data directory.

In order to run the MODIS Reprojection Tool GUI, you must have a current
version of Java installed on your system (at least the Java2 v1.3 Runtime
Environment or the Java 2 SDK v1.3). If you do not plan to use
the MRT GUI, and only intend to use the command-line resampler, then
Java is not required for your installation.

In order to install the MRT GUI, you must know the path to your Java
directory. On Unix systems, you can type "which java" (no quotes) to
determine the path to your current Java executable. This method will
only work if the Java executable is on your path. You can also try
typing "find / -name java", but this will search all mounted file
systems and may take a while to complete. If necessary, ask your system
administrator where the Java bin directory is located.

To determine the Java bin directory on Windows, click on the Windows
Start button and select Find, Files or Folders... Fill in the dialog box
to search all local hard drives for a file named java.exe. Make note of
the directory containing the most recent version of java.exe. If
java.exe does not appear in the Find Files listing, then Java may not be
installed on your system.

If the Java executable is on your path, you can tell which version of
Java is installed on your machine by typing java -version, which will
give you an output similar to the following:

        java version "1.3.1"

If the version number is older than 1.3.1, the MRT GUI is not guaranteed
to work with your version of Java. In this case, you should install a
newer version of Java. The latest version of Java 1.3 or Java 1.4 are
now required for the MRT GUI.

For automatic installation of the MRT, you must be able to supply the
complete pathname of the directory in which you want to install the MRT,
and the pathname of the directory containing the Java executable program
(java or java.exe) on your system.

Once you have this information, you can run the install script. Make
sure you are in the directory containing the installation files (the zip
archive, the unzip program, and the install script) that you have
downloaded from the EDC Web site. On UNIX systems, type "./install". On
Windows, just type "install". Follow the installation instructions
carefully. The installation program will automatically unzip the zip
archive into the MRT directory, and will prompt you for the information
needed to set up your path and environment variables correctly.